PATENT SPECIFICATION 884,918

DRAWINGS ATTACHED.

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Date of Application and filing Complete Specification :
June 30, 1960. *No. 22876/60.*

Complete Specification Published : Dec. 20, 1961.

Index at Acceptance:—Class 137, B3E.

International Classification :—F24f.

COMPLETE SPECIFICATION.

Improvements in or relating to Combined Heating and Cooling Apparatus for Vehicles.

We, S. SMITH & SONS (ENGLAND) LIMITED, a British Company, of Cricklewood Works, Cricklewood, London, N.W.2, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to combined heating and cooling apparatus for vehicles.

According to the present invention we provide combined heating and cooling apparatus for vehicles comprising an air inlet compartment and means to feed air to the inlet compartment, first and second air outlet compartments having discharge ports, the inlet and first outlet compartments being in communication both directly and through air cooling means, the inlet and second outlet compartments being in communication through air heating means, the first and second outlet compartments being in direct communication, first valve means to control flow of air through the inlet compartment to the first outlet compartment both directly and through the air cooling means, and second valve means to control flow of air from the second outlet compartment both through its discharge port or ports and to the first outlet compartment.

It will be seen that when the air cooling means are in operation, the temperature of the air discharged from the first outlet compartment may be controlled by adjustment of the first valve means which control the proportions of air flowing from the inlet compartment to the first outlet compartment—both directly and through the cooling means. When the air heating means are in operation, adjustment of the first and second valve means enables three modes of operation to be obtained: (i) All the heated air may be discharged from the second outlet compartment. (ii) A proportion of the heated air may be discharged from the second outlet compartment, and the remainder passed to the first outlet compartment where it mixes with a variable proportion of unheated air which has flowed directly from the inlet compartment. The discharge from the first outlet compartment is then at a lower temperature than that from the second outlet compartment. (iii) All the heated air may be passed from the second outlet compartment to the first for discharge.

Heating and cooling apparatus for a vehicle in accordance with the present invention will now be described with reference to the accompanying drawings of which:—

Figures 1 to 6 are cross-sectional schematic views of the apparatus showing various modes of operation; and

Figure 7 is a schematic cross-sectional view taken on the line 7—7 of Figure 1.

A generally rectangular housing is formed of top and bottom walls 1 and 2, front and rear walls 3 and 4, and side walls 5 and 6 (Figure 7). A partition 7, parallel to and spaced apart from rear wall 4, divides the space within the housing into front and rear portions. The upper part 14 of the front portion constitutes a first passageway, and the upper part 18 of the rear portion a second passageway. The lower part 22 of the front portion constitutes a third passageway and the lower part 23 of the rear portion a fourth passageway.

[*Price* 4*s.* 6*d.*]

Two heat exchangers are disposed within the front portion, one above the other and spaced apart. The upper first, heat exchanger 8 in the first passageway 14 constitutes the evaporator or expansion chamber of a conventional refrigeration system (not shown) having provision for maintaining the chamber at a constant low temperature. The lower, second, heat exchanger 9 in the third passageway 22 is in the form of a radiator matrix which is supplied with hot coolant from the vehicle engine cooling system (not shown). Flow of coolant is controlled by a thermostatic valve (not shown) having provision for manual adjustment. The heat exchangers are arranged so that air may flow through them in a generally vertical direction.

The space between the heat exchangers constitutes the inlet compartment 10. Two centrifugal blowers 11 and 12 (Figure 7) may force air into inlet compartment 10 through ports in the side walls 5 and 6. Blower 11 is supplied with air from outside the vehicle and blower 12 is supplied with air from the passenger compartment of the vehicle. The blowers are driven by electric motors which may be individually controlled.

At the upper end of the housing an extension to the rear forms the first outlet compartment 13 which communicates with the upper end of passageway 18, and with the upper end of passageway 14 through a port 24 in partition 7 which may be closed by a first flap valve 15.

Compartment 13 is provided with an adjustable discharge nozzle 17. The housing is adapted to be mounted in the vehicle so that nozzle 17 lies adjacent to the interior surface of the vehicle windscreen (indicated at 26). In one position of the nozzle air is discharged through it onto the windscreen, and in a second position away from the windscreen.

At the lower end of the housing a downward extension forms a second outlet compartment 21 which communicates with passageway 22. Passageway 18 communicates at its lower end with compartment 10 through a port 27 in partition 7, and also with passageway 23 (which forms a continuation of it). Passageway 23 communicates at its lower end with compartment 21 through a port 28 in partition 7.

Flow of air from inlet compartment 10 to passageway 18 through port 27 is controlled by a second flap valve 19. Air may be discharged from compartment 21 into the passenger compartment of the vehicle through a port 25 which may be closed by a third flat valve 16.

Flow of air from outlet compartment 21 to passageway 23 through port 28 is controlled by a fourth flap valve 20. The various valves are connected by flexible cables to manual control knobs (not shown).

The operation of the apparatus will be described with reference to Figures 1 to 6.

Figure 1 (Inoperative): All valves are closed and no air is discharged from either outlet compartment.

Figure 2 (Heating): Valves 15, 19 and 20 are closed. Valve 16 is open, and hot coolant is permitted to flow through matrix 9. Air flows from the inlet compartment through the matrix, where it is heated, and is discharged from outlet compartment 21 into the vehicle passenger compartment. The temperature of the air is varied by adjustment of the thermostatic valve controlling the flow of coolant.

Figure 3 (Heating and demisting): Valve 15 is closed. Valves 19, 20 and 16 are open. Hot coolant is permitted to flow through matrix 9. Heated air from outlet compartment 21 passes out of port 25, and also through passageways 23 and 18 where it combines with air flowing directly from the inlet compartment through port 27. This combined flow of warm air is discharged through outlet compartment 13 and nozzle 17 onto windscreen 26 for demisting. The temperature of this air, which is lower than that of the air discharged from port 25, is controlled by the settings of valves 19 and 20.

Figure 4 (Defrosting): Similar to the conditions of Figure 3 except that valves 16 and 19 are closed so that a maximum flow of hot air is directed onto the windscreen for defrosting.

Figure 5 (Cooling): Flow of hot coolant is cut off from matrix 9, and evaporator 8 is placed in operation. Valves 16 and 20 are closed, and 15 and 19 are partially open. Air flows from the inlet compartment through evaporator 8, where it is cooled, and into outlet compartment 13 where it is combined with air passing directly from the inlet compartment through passageway 18. The combined airflow is discharged from nozzle 17 away from the windscreen. It will be seen that the temperature of the combined airflow may be adjusted by means of valves 15 and 19.

Figure 6 (Maximum cooling): Similar to the conditions of Figure 5 except that valve 19 is closed and valve 15 fully open to give the maximum cooling effect.

In any of the above modes of operation, blower 12 may be operated alone as that air is merely recirculated to give the most rapid heating or cooling effect. If blower 11 is operated on its own, fresh air is discharged from the apparatus.

The discharge of hot air, when it is produced, at a low level in the passenger compartment, and of cooled air at a higher level leads in each case to the most even temperature distribution in the passenger com-

partment. Air for demisting the windscreen tends to find its way into the vicinity of the heads of the driver and passengers, and it is found that for comfort this airstream should be at a lower temperature than the air discharged lower down in the vehicle. The mode of operation described with reference to Figure 3 provides such a distribution.

WHAT WE CLAIM IS:—

1. A combined heating and cooling apparatus for vehicles comprising an air inlet compartment and means to feed air to the inlet compartment, first and second air outlet compartments having discharge ports, the inlet and first outlet compartments being in communication both directly and through air cooling means, the inlet and second outlet compartments being in communication through air heating means, the first and second outlet compartments being in direct communication, first valve means to control flow of air through the inlet compartment to the first outlet compartment both directly and through the air cooling means, and second valve means to control flow of air from the second outlet compartment both through its discharge port or ports and to the first outlet compartment.

2. Apparatus as claimed in Claim 1 wherein first and second passageways form the said communication between the inlet compartment and the first outlet compartment, the air cooling means being disposed in the first passageway.

3. Apparatus as claimed in Claim 2 wherein the first valve means comprise a first flap valve arranged to control flow of air in the first passageway and a second flap valve arranged to control flow of air from the inlet compartment to the second passageway.

4. Apparatus as claimed in Claim 3 wherein a third passageway containing the air heating means forms the said communication between the inlet compartment and the second outlet compartment.

5. Apparatus as claimed in Claim 4 wherein a fourth passageway between the second passageway and the second outlet compartment provides, together with the second passageway, the said communication between the first and second outlet compartments.

6. Apparatus as claimed in Claim 5 wherein the second valve means comprise a third flap valve arranged to control flow of air from the second outlet compartment through its discharge port or ports, and a fourth flap valve arranged to control flow of air from the second outlet compartment through the fourth passageway.

7. Apparatus as claimed in Claim 6 wherein the inlet compartment, the first and second outlet compartments, and the first, second, third, and fourth air passageways are formed by a partitioned housing.

8. Apparatus as claimed in any of the preceding claims wherein the discharge ports or ports of the first outlet compartment are in communication with adjustable discharge devices adapted to be mounted adjacent to the base of a vehicle windscreen on the inside, the devices being such that the air discharge may be directed either towards the windscreen or away from it.

9. Apparatus as claimed in any of the preceding claims wherein the air cooling means comprise a first heat exchanger constituting the evaporation chamber or expansion chamber of a conventional refrigeration system having provision for maintaining the chamber at a constant temperature.

10. Apparatus as claimed in 9 wherein the air heating means comprise a second heat exchanger adapted to be fed with hot coolant from the vehicle-engine cooling system.

11. Apparatus as claimed in Claim 10 wherein the flow of coolant through the second heat exchanger is controlled by a thermostat responsive to the temperature of the heat exchanger and having provision for manual adjustment.

12. Apparatus as claimed in any of the preceding claims wherein the means to feed air to the inlet compartment comprise a pair of power driven air impellers, one being adapted to be supplied with air from the exterior of the vehicle, and the other being adapted to be supplied from the passenger compartment of the vehicle.

13. Heating and cooling apparatus for vehicles substantially as hereinbefore described with reference to the accompanying drawings.

For the Applicants,
E. SWINBANK,
Chartered Patent Agent.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1961.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.

FIG.1.

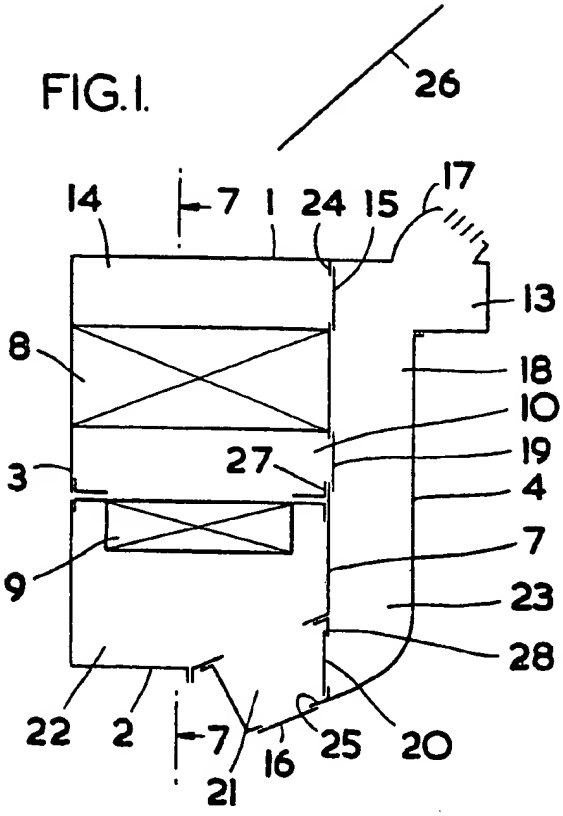
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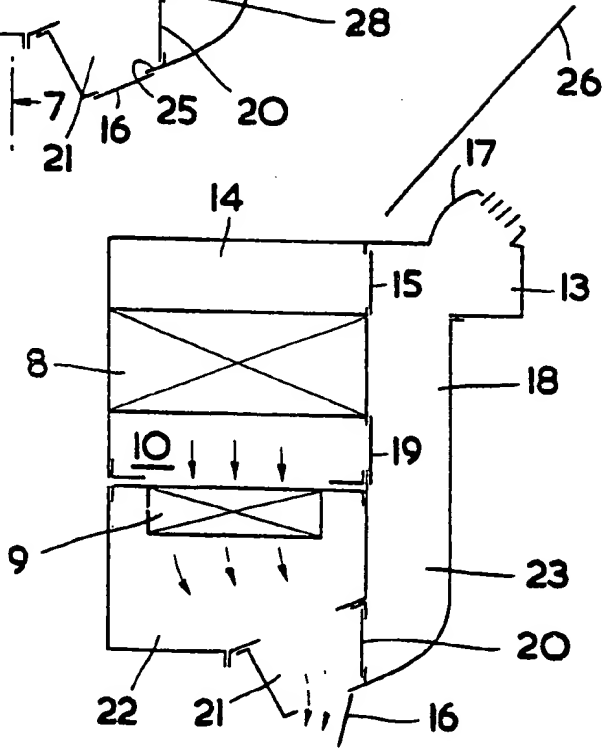
FIG.2.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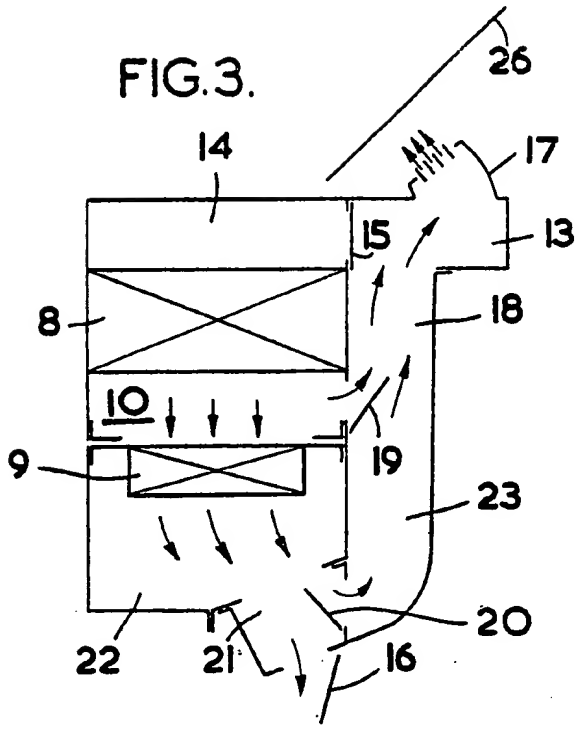
SHEETS 1 & 2

FIG.3.



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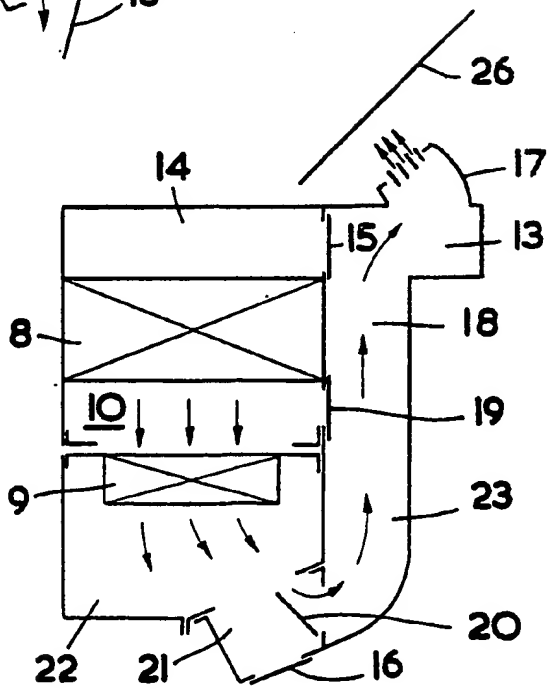

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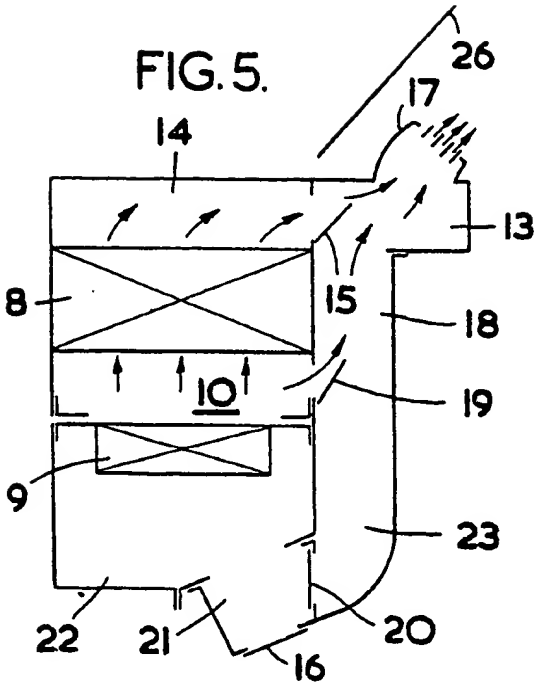
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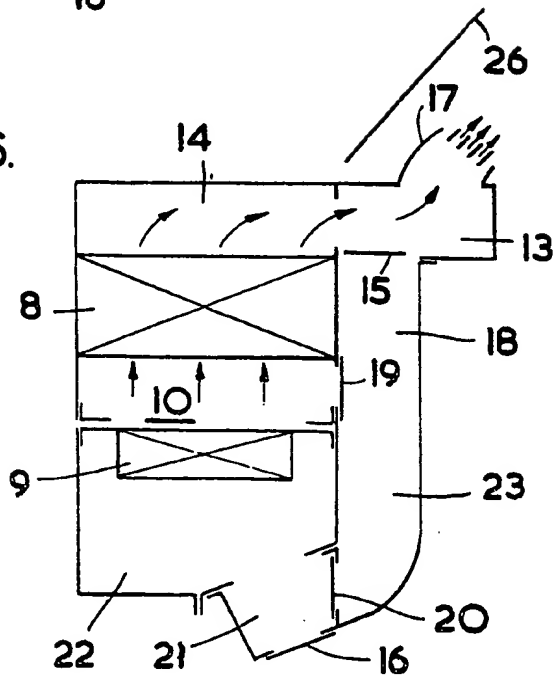
FIG. 6.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SHEETS 1 & 2

FIG.1.

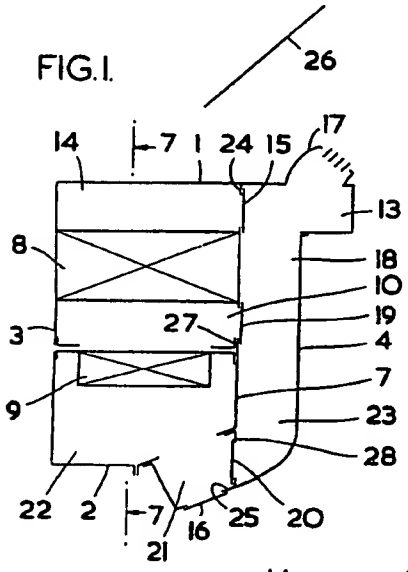


FIG.2.

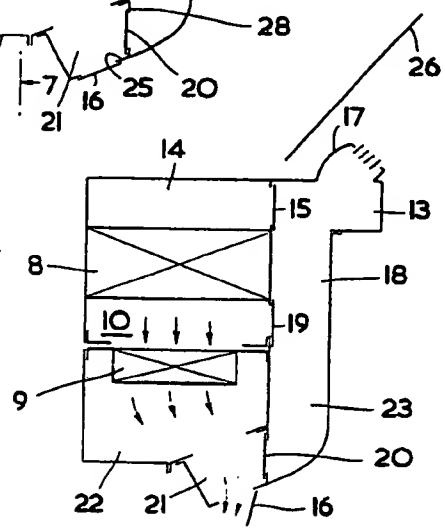


FIG.3.

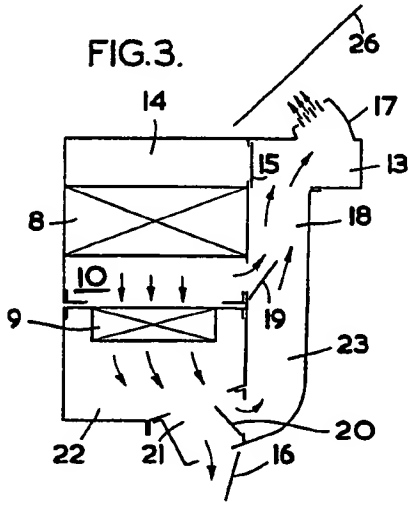
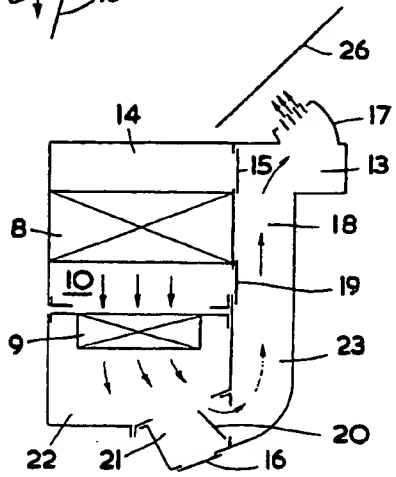


FIG.4.



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SHEETS 3 & 4

FIG. 5.

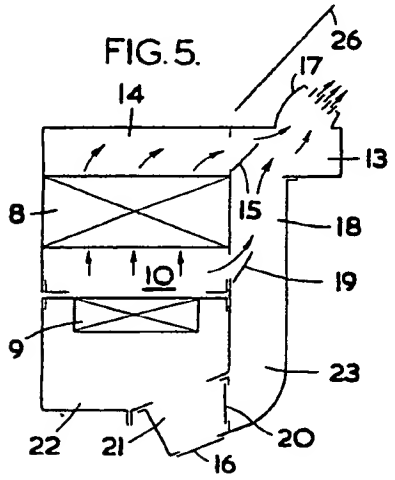


FIG. 6.

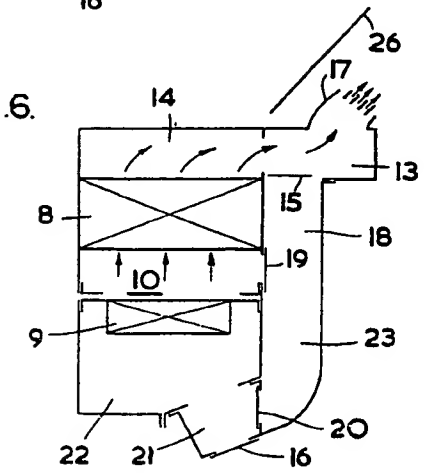
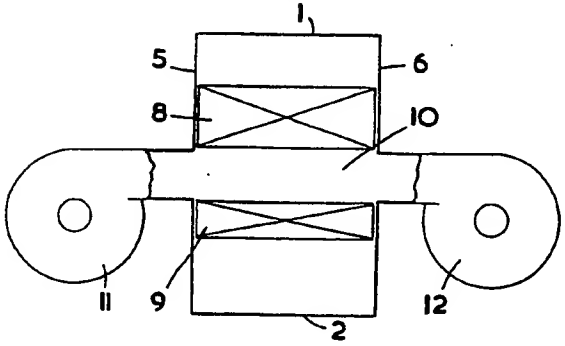


FIG. 7.



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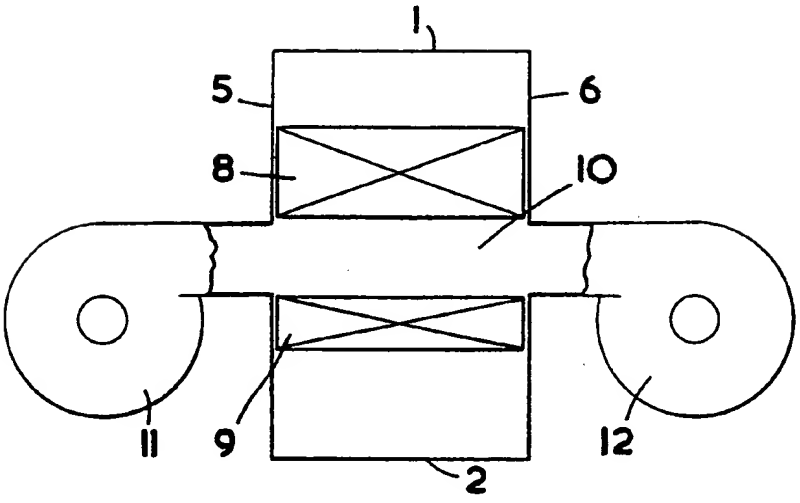
SHEETS 3 & 4

FIG.7.



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